Project 8 – Opportunistic cellular network

A cellular network transmits its traffic to *n* users. Each user has its own FIFO queue on the transmitting antenna. On each timeslot, users report to the antenna a Channel Quality Indicator (CQI), i.e. a number from 1 to 15, which determines the number of bytes that the antenna can pack into a *Resource Block* (RB) according to the table below. Then the antenna composes a *frame* of 25 RBs by scheduling traffic from the users, and sends the frame to the users. A packet that cannot be transmitted entirely will not be scheduled. An RB can only carry traffic for *one* user. However, two or more packets for the *same* user can share the same RB. (e.g., packet 1 is 1.5 RBs and packet 2 is 1.3 RBs, hence ceiling(1.5+1.3)=3 RBs are required to transmit them).

CQI	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Bytes	3	3	6	11	15	20	25	36	39	50	63	72	80	93	93

The antenna serves its users using an *opportunistic* policy: backlogged users are served by *decreasing CQI*. When a user is considered for service, its queue is emptied, if the number of unallocated RBs is large enough.

Consider the following workload for all users: packet interarrival times are IID RVs (to be described later), and their service demands (in bytes) are IID RV (to be described later).

Study the throughput and response time of the above system with a varying workload at least in the following scenarios:

- exponential interarrivals, uniform service demands (the largest packet dimension is such that it fits a frame at the minimum CQI), uniform CQIs.
- Same as above, with *binomial* CQIs, chosen so that the mean CQI of different users are sensibly different.

In all cases, it is up to the team to calibrate the scenarios so that meaningful results are obtained.

Project deliverables:

a) Documentation (according to the standards set during the lectures)
b) Simulator code
c) Presentation (up to 10 slides maximum)